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Rabinowitz's research involved developing new methods in the calculus of variations and applying them to a variety of problems in the area of dynamical systems.

Souganidis' research involved developing new methods in the area of hyperbolic nonlinear pde and applying them to a variety of problems in phase transitions, mechanics and turbulent combustion.

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Some Problems in Nonlinear Analysis

Final Progress Report

Paul H. Rabinowitz and Panagiotis E. Souganidis

April 1, 1994 through January 9, 1998

U.S. Army Research Office

DAAH04-94-G-0047

University of Wisconsin-Madison
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Final Progress Report of Paul H. Rabinowitz

Research was carried out on a variety of problems, mainly in the broad field of dynamical systems. A common theme was the development and use of new methods from the calculus of variations to treat these problems. The results include:

- the introduction and use of renormalized functionals to find solutions heteroclinic to periodics for a family of reversible Hamiltonian systems

- the use of renormalized functionals to find heteroclinic type solutions for a class of PDE's that arise in particular in studying certain water wave problems

- a new method for finding periodic solutions of prescribed energy for a class of singular Hamiltonian systems

- the existence of homoclinic solutions for a class of singular Hamiltonian systems

- developing minimax methods to find multibump solutions for several classes of Hamiltonian systems

- some initial attempts at minimization methods to find multibump solutions of Hamiltonian systems

- new geometrical methods to find chaotic solutions of certain classes of Hamiltonian systems

- a new combination of analytical and variational techniques to find chaotic solutions of Hamiltonian systems

Final Progress Report of Panagiotis E. Souganidis

Research was carried out on a variety of problems, mainly on the broad field of nonlinear hyperbolic pde and their applications to phase transitions, front propagation, mechanics and turbulence combustion. The main theme was the development and use of new methods from the theory of nonlinear pde. The results include:

- the existence and stability of entropy solutions for the system of hyperbolic conservation laws of gas dynamics in Eulerian and Lagrangian coordinates
- the study of a limiting case of the averaging lemma
- the development of a mathematically rigorous theory for premixed-turbulent combustion
- the development of bounds of enhanced turbulent flame speeds for combustion with fractal velocity fields
- the comparison of turbulent flame speeds from complete averaging and the G-equation
- the study of the validity of Huygens principle in premixed combustion
- the development of a new approach to generalized front propagation problems
- the study of the long time asymptotics of general equations and particle systems in anisotropic environments and the rigorous justification of the development of interfaces
- the study of threshold dynamics type approximation schemes for propagating fronts
- the convergence of finite volume numerical schemes for Hamilton-Jacobi equations

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